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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

IN RE PATENT APPLICATION OF:

ALFRED EDLINGER

INTERNATIONAL APPLICATION NO.
PCT/AT01/00225

INTERNATIONAL FILING DATE:
JULY 6, 2001

FOR: METHOD AND DEVICE FOR ATOMIZING METAL MELTS

EXAMINER: UNKNOWN
GROUP ART UNIT: UNKNOWN

Commissioner for Patents
BOX PCT
Washington, D.C. 20231

## PRELIMINARY AMENDMENT

Prior to calculation of the filing fee and examination of this new U.S. National Phase Application filed under 35 U.S.C. § 371, of the International Application PCT/AT01/00225, Applicant respectfully submits the following Amendments and Remarks to be entered into the patent application identified above, and earnestly requests that the Examiner pass this application to allowance.

**AMENDMENTS:**

**IN THE CLAIMS:**

**PLEASE CANCEL ORIGINALLY FILED CLAIMS 1 THROUGH 14.**

**Please add new Claims 15 through 37, renumbered herein as Claims 1 through 22. These new Claims, in clean form, are provided on the following pages.**

CLAIMS:

1. A method for atomizing metal melts, comprising the steps of

providing a tundish in which a liquid metal melt is kept in a molten state, and which has an outlet opening, a bottom inner surface, and an immersion tube;

introducing the liquid metal melt, through an annular gap formed between the bottom inner surface of said tundish and said immersion tube, into the outlet opening; and

ejecting through a Laval nozzle arranged concentrically with said outlet opening a propellant gas having a temperature between 250°C and 1300°C, and a supercritical pressure of between 2 and 30 bars, wherein the propellant gas is contacted with the liquid metal melt at a speed exceeding supersonic speed, with a radial outwardly directed component.

2. A method according to claim 1, wherein the propellant gas is directed by a deflector body.

3. A method according to claim 1, further characterized in that a lance comprising the Laval nozzle for the propellant gas is conducted concentrically in a tube, forming an annular space between said lance and said tube, and that reactive gases such as, *e.g.*, CO, $H_2$, $O_2$ or $H_2O$ vapor, and/or inert gases such as, e.g., $N_2$ or Ar, and/or carbides such as, *e.g.*, WC, TiC or VC, are sucked in through said annular space.

4. A method according to claim 2, further characterized in that a lance comprising the Laval nozzle for the propellant gas is conducted concentrically in a tube, forming an annular space between said lance and said tube, and that reactive gases such as, *e.g.*, CO, $H_2$, $O_2$ or $H_2O$ vapor, and/or inert gases such as, e.g., $N_2$ or Ar, and/or carbides such as, *e.g.*, WC, TiC or VC, are sucked in through said annular space.

5. A method according to claim 3, characterized in that reactive metal powders or additives such as, *e.g.*, SiC, $Al_2O_3$ or $Y_2O_3$ are charged into the gas flow sucked into said annular space.

6. A method according to claim 1, further characterized in that the propellant gas is heated in a heat exchanger surrounding the ejected comminuted particles of the liquid metal.

7. A method according to claim 2, further characterized in that the propellant gas is heated in a heat exchanger surrounding the ejected comminuted particles of the liquid metal.

8. A method according to claim 1, further characterized in that extremely fine solidifying particles of the comminuted liquid metal, which move into a cooling chamber, are sucked off below the entry point of the liquid metal melt, and said extremely fine particles are discharged from said cooling chamber through a sluice.

9. A method according to claim 2, further characterized in that extremely fine solidifying particles of the comminuted liquid metal, which move into a cooling chamber, are sucked off below the entry point of the liquid metal melt, and said extremely fine particles are discharged from said cooling chamber through a sluice.

10. A method according to claim 1, further characterized in that a pressure of 1.5 to 25 bars is maintained within the tundish.

11. A method according to claim 2, further characterized in that a pressure of 1.5 to 25 bars is maintained within the tundish.

12. A method according to claim 1, further characterized in that a pressure of 1.5 to 10 bars is maintained within a cooling chamber.

13. A method according to claim 2, further characterized in that a pressure of 1.5 to 10 bars is maintained within a cooling chamber.

14. A device for atomizing metal melts, comprising:

a tundish (1) containing a liquid metal melt (2) and having an outlet opening for the liquid metal melt, and an interior surface;

an immersion tube (4) immersed in said liquid metal melt (2), forming an annular gap between said immersion tube (4) and said interior surface of the tundish (1), said annular gap surrounding said outlet opening for the liquid metal melt; and

a height-adjustable lance (7) with a Laval nozzle for ejecting a propellant gas.

15. A device according to claim 14, further comprising a deflector body (10) arranged in a height-adjustable manner in the widening opening region of the Laval nozzle (9) or

following thereupon as viewed in the flow direction, wherein the clear cross section between the nozzle (9) and the deflector body (10) is designed to increase in the axial direction towards the outlet end and to be larger than the narrowest cross section of the Laval nozzle (9).

16. A device according to claim 14, further characterized in that the lance (7) opens in the outlet opening of the tundish (1) below the lower edge of the immersion tube (4).

17. A device according to claim 15, further characterized in that the lance (7) opens in the outlet opening of the tundish (1) below the lower edge of the immersion tube (4).

18. A device according to claim 14, further characterized in that the outer diameter of the lance (7) is smaller than the clear diameter of the immersion tube (4);

the lance (7) is sealingly guided through a lid (6) of the immersion tube (4); and

a duct (24) opens into the space of the immersion tube (4) surrounding the lance (7) for the supply of gases and/or reactive metal powders and/or additives.

19. A device according to claim 15, further characterized in that the outer diameter of the lance (7) is smaller than the clear diameter of the immersion tube (4);

the lance (7) is sealingly guided through a lid (6) of the immersion tube (4); and

a duct (24) opens into the space of the immersion tube (4) surrounding the lance (7) for the supply of gases and/or reactive metal powders and/or additives.

20. A device according to claim 15, further characterized in that the deflector body (10) is designed as a cone having deflector surfaces provided on its jacket.

21. A device according to claim 20, further characterized in that the deflector surfaces extend in a curve shaped in an S-like manner, and, in the peripheral direction, terminate so as to be directed at the tangent of the base circle of the conical body, each under the same angle.

22. A device for atomizing metal melts, comprising:

a tundish (1) containing a liquid metal melt (2) and having an outlet opening for the liquid metal melt, and an interior surface;

an immersion tube (4) immersed in said liquid metal melt (2), forming an annular gap between said immersion tube (4) and said interior surface of the tundish (1), said annular gap also surrounding said outlet opening for the liquid metal melt;

a height-adjustable lance (7) with a Laval nozzle for ejecting a propellant gas,

characterized in that the lance (7) opens in the outlet opening of the tundish (1) below the lower edge of the immersion tube, and the outer diameter of the lance (7) is smaller than the clear diameter of the immersion tube (4), and the lance (7) is sealingly guided through a lid (6) of the immersion tube (4);

a deflector body (10) arranged in a height-adjustable manner in the widening opening region of the Laval nozzle (9) or following thereupon as viewed in the flow direction, wherein the clear cross section between the nozzle (9) and the deflector body (10) is designed to increase in the axial direction towards the outlet end and to be larger than the narrowest cross section of the Laval nozzle (9), characterized in that the deflector body (10) is designed as a cone having deflector surfaces provided on its jacket, and the deflector surfaces extend in a curve shaped in an S-like manner, and, in the peripheral direction, terminate so as to be directed at the tangent of the base circle of the conical body, each under the same angle; and

a duct (24) opening into the space of the immersion tube (4) surrounding the lance (7) for the supply of gases and/or reactive metal powders and/or additives.

**REMARKS:**

By this Amendment, the Applicant has canceled originally filed Claims 1 through 14, and added new Claims 15 through 37, renumbered herein as Claims 1 through 22, to more clearly define the subject matter of the invention in compliance with U.S. Patent Office rules. Applicant respectfully submits that the application is in condition for allowance.

The Commissioner is hereby authorized to charge any additional fees associated with this communication to our Deposit Account No. 50-0305.

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The Examiner is encouraged to call the undersigned at the direct number (312) 845-3919 with any questions that arise in connection with this application.

Respectfully submitted,

By _____
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Date: March 6, 2002
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